

Perspectives of Utah Educators on Strategies to Encourage the Pursuit of Mathematics and Science

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Introduction

The education of Utah students in science, technology, engineering, and mathematics (STEM) is critical to our continuing economic growth. Recent studies such as, *Rising Above the Gathering Storm* and *Keeping America Competitive*, have highlighted the challenge of increasing student interest in mathematics and science at a national level and outlined possible strategies for improving mathematics and science education.

Utah State Office of Education Mathematics and Science Specialists have recently completed a state-wide study to determine the scope of the issues and opportunities in Utah and possible strategies to encourage the pursuit of mathematics and science. Focus groups were held at the Utah State Office of Education, Iron School District and Carbon School District. Sixty two educators in the focus groups shared their concerns and possible solutions to the USOE specialists. Several factors were identified during these focus groups and separated into four categories:

- Teacher Quality
- Student Interest
- Public Perception
- Rural School Issues

After discussing the problems and concerns, the members of the focus groups identified possible solutions to encourage student interest and involvement in pursuing STEM studies and careers.

Teacher Quality

Utah schools share the national concern of having enough mathematics and science teachers with strong content knowledge in the classroom. There is a strong positive correlation between teachers with a solid background in mathematics and science and their ability to engage students in the subject matter.¹ Furthermore, “having a major in the subject taught has a significant positive impact on student achievement”.² In Utah only 65% of mathematics teachers and 81% of science teachers have a major or minor in their field and hold regular certification.³

Utah teachers recognize that many mathematics and science teachers lack sufficient time and funding for ongoing professional development, including professional development that leads to proper endorsements. The recent focus on reading and funding formula changes have decreased professional development opportunities for mathematics and science teachers. Teachers of mathematics and science without adequate professional development lack confidence to design and implement lessons that inspire students. This is particularly a problem in elementary and rural schools.

Possible Strategies

- Compensation for mathematics and science professional development and collaboration patterned after the CTE model
- Balance teacher schedules with fewer preparations and limit extracurricular assignments for new teachers
- Earmarked funding for STEM professional development
- Provide funding for *long term ongoing* professional development
- Provide funding for mentoring/coaching to increase teacher enthusiasm and ability to develop lessons that engage students
- Integrate technology into the classroom by providing hardware, software, and teacher training

Student Interest

Students' high school experiences affect students' success in college-level courses and their decisions about pursuing STEM degrees and careers. The Government Accountability Office (GAO) reports that approximately 40% of those who leave science fields of study in college do so because of inadequate high school mathematics and science preparation.⁴ High school students who are engaged and interested in mathematics and science classes will take higher level courses which increase the probability of success in college STEM fields. Recent increased emphasis on basic skills and language arts has decreased the amount of time spent on reasoning and problem solving skills critical to mathematics and science.⁵

In Utah large class sizes and inadequate funding limit teacher ability to design and implement engaging instruction. Large class sizes hinder the ability of teachers to give individual attention in mathematics and raise safety concerns for science laboratory experiences. Utah teachers report there is a perceived decrease in the value of mathematics and science as a result of the increased attention to reading in their schools. There are few extracurricular opportunities for students to engage in mathematics and science outside of the classroom. A large amount of funds are available to support the needs of students at risk; however, there are limited funds to support programs that engage gifted students in STEM pursuits. These gifted and talented students are the ones who are most likely to continue mathematics and science after high school.

Possible Strategies

- Mathematics and science class size reduction initiative
- Provide service-learning activities within the fields of mathematics and science to involve the community and engage student interest
- More support for existing mathematics and science extracurricular activities such as science fairs and Math Counts
- Competitions with scholarship rewards
- Develop partnerships with businesses and universities to create new mathematics and science extracurricular opportunities that are directly related to and increase awareness of career opportunities
- Recognize gifted students as special-needs students worthy of earmarked funding

Public Perception

Several major national reports point to the importance of improving mathematics and science education. The need for an increased number of STEM professionals is cited in major research publications and popular journals. Yet, students receive mixed messages from counselors, other teachers, and parents regarding their future involvement in these fields.

In Utah, students are sometimes discouraged from taking advanced coursework that could possibly lower their GPAs. Many believe that mathematics and science is difficult; therefore, it is socially acceptable to have poor skills in those areas. Many parents remember science and mathematics as boring because they were taught lecture-style with lots of memorization, so they allow their students to opt out of higher level courses. In some rural Utah areas mathematics and science are seen as less lucrative than other careers. Limited vision of the usefulness of mathematics and science drives public perception.

Possible Strategies

- Inform administrators, counselors, teachers, and other adults in education how to support mathematics and science education
 - Counsel students to take more, not less, mathematics and science
 - Career day with parent involvement
 - Showcase student work and importance of mathematics and science education at parent nights
- Public service campaign
 - Promoting mathematics and science careers
 - Addressing the importance of mathematics and science
 - Famous people endorsing mathematics and science
 - Highlighting how mathematics and science classrooms today are different than they were 20 years ago
 - Billboards, commercials, early morning news shows

Rural School Issues

Rural focus groups identified several issues unique to their locations. Many of the school districts in rural areas face lower funding because of their small school sizes, but have increased costs due to their locations. Small populations and geographic remoteness lead to other problems as well.

The smaller population of rural schools creates unique problems with staffing and course offerings. In many rural districts there are not enough resources to support a dedicated mathematics or science specialist or teacher leader. In urban areas these specialists support teachers in providing professional development and accessing resources. In rural areas it is also very likely that one teacher will teach several different courses and have several extra-curricular assignments. These teachers have limited time to develop engaging lessons or pursue professional development. Limited staff leads to limited course offerings, especially for advanced classes with lower enrollment. In many cases, courses must be consolidated leading to multiple ability levels in the same class.

The geographic remoteness of rural schools creates other problems. It is difficult for teachers to attend professional development, sometimes even within their own district. Small faculties and travel distances make the per teacher cost of mathematics and science professional development prohibitive. In addition, the geographic isolation of some communities makes finding qualified teachers difficult.

Possible Strategies

- A change in the funding formulas for rural schools, specific to mathematics and science
- Earmarked funding for increased F.T.E.s in mathematics and science for rural districts
- Rural consortia for mathematics and science specialists
- Increased opportunities for field trips and guest speakers in outlying areas

Notes

¹United States Government Accountability Office, *Federal Science, Technology, Engineering, and Mathematics Programs and Related Trends*, October, 2005, p. 33.

²Jeffrey J. Kuenzi, Christine M. Matthews, Bonnie F. Mangan, *Science, Technology, Engineering, and Mathematics (STEM) Education Issues and Legislative Options*, Congressional Research Service, May 22, 2006.

³CCSSO, *Meeting NCLB Goals for Highly Qualified Teachers: Estimates by State from Survey Data*, October 2003. p. 10-11.

⁴United States Government Accountability Office, *Federal Science, Technology, Engineering, and Mathematics Programs and Related Trends*, October, 2005, p. 34-35.

⁵Robert C. Pianta et al., "Teaching: Opportunities to Learn in America's Elementary Classrooms", *Science*, Vol. 315, April 3, 2007.

References

Association of American Universities. *National Defense Education and Innovation Initiative: Meeting America's Economic and Security Challenges in the 21st Century*. (2006). Washington, DC: Author.

Coble, Charles, and Allen, Michael. (2005) *Keeping America Competitive: Five Strategies to Improve Mathematics and Science Education*. Washington, DC: Education Commission of the States.

Committee on Prospering in the Global Economy of the 21st Century: An Agenda for American Science and Technology. (2007). *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*. Washington, DC: The National Academies Press.

Council of Chief State School Officers. (2003). *Meeting NCLB Goals for Highly Qualified Teachers: Estimates by State from Survey Data*, Washington, DC: Author.

Kuenzi, Jeffrey J., and Matthews, Christine M., and Mangan, Bonnie F. (2006) *Science, Technology, Engineering, and Mathematics (STEM) Education Issues and Legislative Option*. Congressional Research Service. Washington, DC: The Library of Congress.

Pianta, Robert C. et al., (2007). *Teaching: Opportunities to Learn in America's Elementary Classroom* (pp.1795-1796). *Science* (Vol. 315, Issue 5820). Washington, DC: American Association for the Advancement of Science.

United States Government Accountability Office. (2005) *Federal Science, Technology, Engineering, and Mathematics Programs and Related Trends*, Washington, DC: Author.